Perithecia forte interdum subtus (exoperithecio) subincoloria, et sporæ ad faciem stirpis *Verrucariæ epidermidis* vergentes. Paraphyses nullæ rite evolutæ, nec filamenta ostiolaria ulla visibilia (D. Fuisting ea dixit "periphyses;" melius dicerentur *anaphyses*, si nomine novo egeant). Apothecium latit. circiter 0·1 millim.

XL.—*On the Morphological Structure and the Motory Phenomena of the Contractile Substance of the* Polythalamia (Gromia oviformis)*. By M. Reichert.

1. In the Polythalamia two substances are distinguishable, independently of the shell: the contractile substance of the body, and the colourless constituent which forms the central mass of the body and contains colourless and coloured corpuscles as well as vesicles.

2. Nothing has been accurately determined in regard to the morphological composition of the central substance of the body containing the vesicles, in *Gromia oviformis*. Vesicular bodies of the size and structure described by M. Schultze, 'Ueber den Organismus der Polythalamien,' &c. p. 21, and figured in pl. 1. fig. 6, pl. 7. figs. 10 and 12, were not observed. Whether the apparent vacuoles of the contractile cortical substance, which are not described by this observer, led to the idea of the existence of vesicular bodies, or whether I have not been so fortunate as to obtain animals with true vesicles situated in the central substance of the body, future observations must decide.

3. The contractile substance of the body forms the cortical layer of the soft body of the Polythalamia, which surrounds the central substance containing the vesicles. Whether this was provided at the mouth of the shell with an orifice could not be ascertained in *Gromia oviformis*; but in one instance a granular flocculent mass, probably arising from the central substance, was observed at the orifice of the shell. The contractile substance of the body in *Gromia oviformis* forms a depressed ellipsoidal hollow sac corresponding in external form to that of the entire body, and hence accommodates itself, as in other Polythalamia, to the shell, with the necessary regard to the siphons. It probably takes part in the formation of the shell, but appears subsequently to separate almost entirely from it, as the sea-water enters between the shell and the cortical substance even at its wide commencement; it is also well known that the soft body of *Gromia oviformis* partly leaves the shell. Besides contractility,

* Translated by J. W. Griffith, M.D., F.L.S., from the 'Monatsbericht' of the Berlin Academy, Aug. 1865.

the cortical substance of the soft body probably also possesses the property of producing excretions by which animals forming its food are killed. It also exhibits phenomena of sensation; for the extended processes retract on contact with foreign bodies. It is probably also a respiratory organ, and the active motion of its granules may contribute to the constant change of the sea-water. From the manner in which the many-chambered Foraminifera enlarge and grow, it can scarcely be doubted that it plays an important part in this formative process. Lastly, I have observed that segments separate from it and apparently disappear entirely; so that it must undergo a kind of regenerative process, and restoration must take place in the remaining cortical layer from regeneration by intussusception.

4. The contractile cortical substance of the body of the Polythalamia in a state of rest cannot be recognized as a distinct constituent, even with the aid of the microscope; it forms so thin a layer that its optical section, with the thickness of the body of the animal and the apparently shapeless central substance of the body containing the vesicles, appears merely as a boundary line of the latter and without a double contour. But it is distinctly visible when thickened by contraction and evolving the processes, as well as when the central mass containing the vesicles is passively pushed against it. Although it may originally have been formed from a group of cells, yet when fully developed there is not the slightest trace of any distinct components. It is perfectly hyaline and colourless in the pseudopodia, but sometimes becomes coloured at condensed spots. At these condensed spots and in the larger processes it also appears finely granular, and hence appears under the microscope as if it contained larger granules. Although in other low invertebrate animals the presence of similar true granules in the contractile substance is undoubted, this must at present be denied in the case of the contractile substance of the Polythalamia, as the granular appearance only occurs during the state of contraction, and must therefore be attributed to irregularities of the surface.

5. In regard to the motory phenomena of the body of the Polythalamia, which must be brought into connexion with the contractility of the cortical substance, I distinguish active and passive. To the passive belong the movements and the often apparently rotating motions of the central substance of the body, arising from the peristaltic constrictions of the contractile mantle and the locomotion of the entire body. All the active motory phenomena are recognizable by general or local alterations in the external form and morphological structure of the contractile cortical substance.

a. The contractile property of the cortical substance is exhi-

bited in the simplest manner by greater or less constriction of the ellipsoidal body of the Polythalamia, which occurs slowly and slowly changes position. At the constricted spot the contractile substance is thickened, and its optic section exhibits the form of a narrow sickle with the concavity placed outwards. These constrictions are regularly accompanied by passive movements of the central substance of the body, which contains the vesicles.

b. On every part of the contractile cortical layer the contractile action gives rise to processes in the form of tubercles, warts, papillæ, also flat knob-like prominences and lamellæ, and, lastly, elongated, either regular or somewhat irregular processes. These prominences and processes are only formed, as far as the present observations extend, upon the outer surface of the contractile cortical layer. They appear either at the orifice of the shell or upon a protruded segment of the entire body of the animal; but they are also developed within the shell, at any part of the surface of the body. In the latter case they give rise to the appearance of vacuoles and alveoli, which, however, are filled with sea-water and exist upon the surface of the body, and not within the central substance containing the vesicles. The elevations commence with an aggregation of contractile substance, small at first, at some part of the boundary of the contractile membrane; they then gradually enlarge by the addition of more matter from the surrounding parts, and the contractile membrane is seen to move over the central substance of the body containing the vesicles. By increase of the contraction, new elevations of various forms are sometimes developed upon a lamellar or elongated process, so that the originally membranous contractile lamella thus assumes variously branched forms.

c. The most slender kind of the elongated processes forms the so-called pseudopodia of the Polythalamia. These are most strikingly developed outside the shell, at the orifice; but they exist also within the shell during the above-mentioned formation of vacuoles. In the sarcodic net, as it is called, formed by them, membranous plates of the contractile substance are sometimes so inserted, as shown by a described observation, that as it were a portion of the contractile substance, from which pseudopodia are developed, maintains the connexion with the other parts of the contractile cortical layer merely by a slender pseudopodiform filament. The pseudopodia may arise directly from the cortical substance; but they are usually developed from stouter processes, in consequence of an increase of the contractile action. The so-called granules observed in the granular movement must be regarded as very minute wart-like elevations of the membranous contractile substance. They occur

most frequently in the pseudopodia; but their movement is observable in all the processes, even in the unthickened and elevated contractile membrane, both within and outside the shell.

d. On return to the so-called state of rest, each process retracts to exactly the same place in the contractile sac or the lamella as that from which the elevation occurred. In the branched forms the retraction commences at the terminal branches, and at the same time the movement of the granules ceases; that of the trunks follows. Hence it may be regarded as a law, that the particles of the contractile cortical layer protruded by the contraction, after return to the state of rest, lie in exactly the same order and relative position as they did when the contraction began.

e. All motory phenomena in which large masses of the contractile substance are concerned, exhibit a certain sluggishness at their commencement as well as at their recedence. A stout cylindrical process always requires a considerable time for its formation, during which new contractile matter is being added—as much as half an hour or even more; the development of the more slender pseudopodia, and especially of the granules, takes place rapidly.

f. The contractile action in the granular movement is moreover remarkable from the circumstance that in most cases, immediately after the state of rest has taken place, it causes a similar action in the adjoining contractile substance, producing a movement of waves, resulting from contraction, running in various directions. The law of these waves has not hitherto been determinable; according to appearances, the commencement, the cessation, and, in the case of the plates and membranes of the contractile substance, also the direction of the motion of the granules ensue with perfect irregularity. Moreover, although the appearance of a so-called granule of the granule-movement gives rise to a similar contractile motion in the adjacent parts, yet instances have often occurred to me in which granules have appeared and remained, without setting a contraction-wave in motion. It may be regarded as a peculiarity of the motory phenomenon of the contractile cortical layer, that every movement of contraction may remain at a certain state of intensity for several hours.

Comparison of the Contractile Substance of the Bodies of the Polythalamia *with Muscular Fibre.*

The comparison of the contractile cortical layer with muscular fibre will refer exclusively to the morphological phenomena, and what may be deduced from them to illustrate the relative law of the contractile action. What takes place within the

contractile muscular fibre on its transition from the state of rest to that of action, and the reverse, is still very obscure; there is even controversy upon its minute structure. Still an attempt to compare the two different forms of contractile substance at present known with each other appears justified, so long as only recognized and undoubted facts are brought into comparison, and thus new aspects and some progress, although but slight, may be made towards the further explanation of the contracting-power of the two structures.

The following are the properties of muscular fibre which should be prominently brought into comparison:—

1. The contractile particles of the muscular fibres are arranged with special regard to the long axis of a cylinder or to some kind of longitudinal axis: every muscle consists of an aggregation of these longitudinally arranged contractile morphological elements.

2. No other means of recognizing the organism of the muscular fibres as a whole are known, except those which refer to the contractile power.

3. The contractile action is accompanied by changes in the form of the muscular fibres, which I have designated active motory phenomena. The passive motory phenomena are exhibited in the neighbourhood of the contractile substance by displacement of the substance situated there, and any so-called passive sources of motion of the organisms which may be present—by conversion of the original pressing force of the shortened muscular fibre into tractive force, &c.

4. In regard to the active phenomena of motion, the following facts are established:—

a. On the transition of the contractile substance of the muscular fibre into the so-called active or contracted state, it diminishes in longitudinal and increases in transverse section, either without or with but little change of volume. Or this may be expressed thus:—The slender elongated body is finally changed into a more or less thick plate or disk. On return to the state of rest, the original elongated form is restored.

b. The shortening and thickening on the one hand, as also the elongation and diminution of breadth on the other, may apparently occur suddenly in the entire muscular fibre; they may, however, run as a contraction-wave, distinctly perceptible under the microscope, from one end to the other.

c. The contraction may be limited to or localized in any segment of the length of the muscular fibre.

d. The contraction may stop at any intermediate state within the most extreme limits; it may then either increase or pass from the state of action to that of rest.

e. During the contraction, the particles of the contractile substance must be displaced in a manner corresponding to the form of the state of action and of rest, and therefore according to a law. It must thus be conceived that the particles of the contractile substance during each state of action and of rest must have a determinate absolute and relative position corresponding to the form in each case, that their displacement during the contraction is in this way regulated according to a law, and that the particles, after displacement, return to exactly the same absolute and relative position as that in which they were previously. Every other change in the absolute and relative position of the particles is excluded from the contractile action; hence the uniform mobility in every direction belonging to liquids is absent, as the absolute and relative position of the particles to each other in each case would depend on accidental external circumstances, and would comprise in itself the possibility of any changes in relative position. The contraction of organized bodies is also distinguished from elasticity, quite independently of other phenomena, by the mobility of the particles only occurring in a definite direction, regulated with regard to the organized form.

By comparison of the morphological properties and active motory phenomena of the two contractile structures, the following three differences become evident:—

1. Muscular fibres are elongated contractile formations, in which the contractile particles are arranged with regard to a longitudinal axis during the state of rest. What the special form of the fibre may be, whether cylindrical or spindle-shaped, or flattened and terminating in a lancet-shaped point, as the smooth unstriped muscular fibres, it may often be difficult to decide. But, for comparison, the fact is sufficient, that the contractile particles in a muscular fibre are arranged with regard to a longitudinal axis.

Moreover muscular fibres exist as separate contractile elements, by the aggregation of which the muscles and muscular laminæ of the more highly developed animal organisms are formed.

The contractile cortical layer of the Polythalamia forms during the state of rest a very thin membranous expanded contractile structure, in which the contractile particles are arranged with respect to a body expanded in breadth, or a disk. This layer, whether originating from cells or not, forms a continuous whole, in which no distinct contractile elements can be detected, with our present resources, in fully developed animals.

2. In muscular fibres the property of contractility is, as far as our present observations extend, the principal, if not the only consideration to be taken into account, and to be estimated in

the structure as a whole. The contractile cortical layer of the Polythalamia is a principal constituent of the body as a whole, upon which its external form depends, and which exerts an action in regard to the entire body, not merely by its contractility, but also by its respiratory secretory power, &c.

3. The muscular fibre, on transition from a state of rest into the so-called active state or that of contraction, becomes changed into a flattened disk-shaped body. The contractile cortical layer of the Polythalamia, on transition into the active state, as is well known, appears in extraordinarily varying forms. When, however, it is considered that this contractile structure forms a continuous whole, in which the contraction ensues at any spot and to any extent, with the attraction of new contractile particles, which augment the mass in action, alter the form, and, lastly, may increase to any extent, the distinctive and essential relation on transition into the state of contraction may be characterized by the words "the contractile membranous plate finally changes into an elongate, under certain circumstances cylindrical body." If the contractile energy is of but little intensity and is limited to a small spot, this form of contraction will appear as a small tubercle, and under the microscope as a minute granule upon the contractile membrane. If the tubercle enlarges, a more or less elongated papillary body becomes developed from it, which appears as a tentacle or a pseudopodial process upon the contractile cortical layer continuous with it and in a state of rest. Lamellar processes and alveolar spaces will be formed by the contractile force of a segment of the contractile cortical layer corresponding to this form. Branched forms may be produced by increase of the contractile force in already existing processes, with attraction of new masses. A remarkable circumstance is, that the various forms resulting from contraction, as far as the present experiments extend, only occur upon the outer surface of the contractile layer. The circumstances which are in action here are unknown; but the law that the contractile cortical layer of the Polythalamia which in a state of rest forms a plate or disk, on passing into the active state finally assumes elongated variable forms, is not thereby altered.

Of the three above-named differences, the first two, which refer to the purely morphological question, do not at present allow of further comparison. Both contractile structures are at all events morphologically of entirely different value and of different importance. The rational morphological relation of the two contractile structures to each other can only be determined hereafter by an accurate knowledge of the history of the development of the body of the Polythalamia and of the mus-

cular fibre, as also a comparative anatomical consideration of the entire structure of the Polythalamia and the animal organisms in which distinct muscular fibres occur. By the words, "that the contractile cortical layer of the Polythalamia is an undeveloped muscular mass, sarcode, or protoplasm," is as little or even less advance made than by the expression "that the Polythalamia are undeveloped vertebrata."

In regard to the motory phenomena, in which the contractile action is expressed, the differences are very striking at first sight. In the case of the muscular fibre (for the sake of simplifying the comparison and, by comprising the extremes, allowing the law to be surveyed with great nicety), a cylindrical contractile substance becomes converted by contractile power into a *disk with a circular outline*, possessing nearly or absolutely the same volume; in the case of the contractile cortical substance of the Polythalamia, a disk with a circular outline into a *cylinder*. Accurate examination, however, teaches us that different forms only are concerned, under which the contractile substance is applied and its contractility realized for the accomplishment of spontaneous and involuntary movements and functions in the organism. As regards the expression of the contractile action, *i. e.* of the movement of the contractile particles in a certain direction corresponding to each change of form of the contractile structure, the distinction of a so-called active or passive state is of secondary importance. The former force, which urges and transfers the contractile particles from a position arranged according to the long axis of a cylinder, into that in which the contractile particles are situated with regard to the axis of the cylindrical section and in the form of a disk, is in every respect exactly the same, by whatever cause, on transition into the state of rest, the displacement of the contractile particles from the discoidal form into that of the cylinder is produced; and so *vice versâ* in regard to the contractile action occurring in the Polythalamia.

If, however, the transition of the contractile structure into the so-called state of rest and the form of this state is also taken into account as an active motory phenomenon, the muscular fibre and the contractile cortical layer of the Polythalamia agree perfectly as regards their contractile action. In both are recognizable the same fundamental forms, which appear in the alternation of two contractile tissues in a state of action, viz. the elongated cylindrical, and the disk or plate, expanded in breadth or into the section of a cylinder—the difference referring simply to the circumstance that in the two contractile tissues, as already stated, quite independently of other morphological relations, the same fundamental forms are not conceived in the

so-called active and passive states of the contractile action. Hence it results, from the comparison of the morphological properties and motory phenomena of muscular fibre and the contractile cortical layer of the Polythalamia, that the contractile substance during its action appears in two forms—the elongated (under certain circumstances cylindrical) form, in which the contractile particles are arranged with regard to a long axis, perhaps that of a cylinder; and the form of a plate or disk, in which the arrangement of the contractile particles has regard to the axis lying in the section of the cylinder. The contractile action itself is exhibited in the displacement of the contractile particles from one fundamental form to the other, and *vice versâ*. Each of the two principal or fundamental forms of the contractile substance in the animal organisms may be realized as the so-called active state, or as that of rest. In the muscular fibre the arrangement of the contractile particles with relation to the longitudinal axis of the cylinder is conceived as the state of rest, the discoidal form as the active form; while the reverse occurs in the Polythalamia.

XLI.—*On a new Species of* Astacus.

By Dr. E. von Martens.

The Zoological Museum in Berlin has recently received from Dr. Richard Schomburgk a species of crayfish, almost equal in size to a lobster, from the Murray River, Australia. Dr. J. E. Gray, in a paper on the Australian Crayfishes, embodied in Eyre's 'Journal of Expeditions of Discovery in Australia,' vol. i. 1845, p. 409, mentions a large species living in the said river, weighing about two pounds, and possessing the same flavour as the European lobster. This may be the same; but, as I could not find elsewhere a zoological description of it, I venture to regard and to describe it as new.

Astacus armatus.

Rostrum of the cephalothorax as long as the peduncles of the outer antennæ, pointed, furnished on each side with four teeth, the posterior ones smaller; its lateral edges continued backwards on a short extent of the cephalothorax in the form of a raised ridge. A single spine behind the middle of the orbit, somewhat behind the orbital edge, and continued backwards in a similar very short ridge. The sides of the cephalothorax, the hepatic as well as the branchial region, furnished with scattered conical spines, each enlarged at its basis, as if placed on a cushion. The lateral lamina of the outer antennæ of the same spiniform shape as in *Homarus vulgaris*, but somewhat longer. Two strong spines on the interior edge of the carpus, the foremost much stronger.